Matrix™ TOTAL FLUID MANAGEMENT SYSTEM

GRACO

Tank Level Monitor (TLM)

312964C
EN

- Monitors tanks levels for oil and anti-freeze mixtures -

Part No. 256285

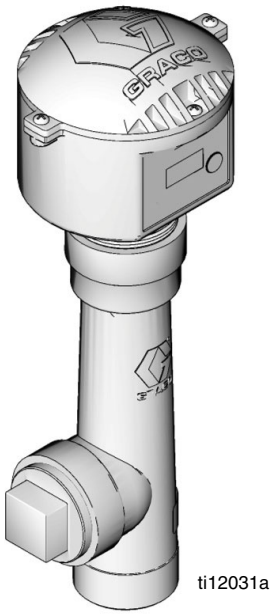
Use with Graco Matrix 3.0 Software only.

US Patent D484,819

Important Safety Instructions

Read all warnings and instructions in this manual. Save these instructions.

- ***Not for use in hazardous locations or in explosive atmospheres!***



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NOTICE

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive!** Many of these products are chemically incompatible with the PC/ABS plastic.
- Use the Graco-supplied down tube 15U731 only. Do not replace down tube with any other tube.

The Matrix Tank Level Monitor contains an RF device with the following approvals:

FCC ID: TFB-FREESTAR
IC: 5969A-FREESTAR

Industry Canada Statement
The term “IC” before the certification/registration number only signifies that the Industry Canada technical specifications were met.

N14939 - FREESTAR
ZFMSM-101-1 (CEL) / FS24-100ST (LSR)

CE

PROVEN QUALITY. LEADING TECHNOLOGY.

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbol refers to procedure-specific risk. Refer back to these warnings. Additional, product-specific warnings may be found throughout the body of this manual where applicable.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

When flammable fluids are present in the work area, such as gasoline and windshield wiper fluid, be aware that flammable fumes can ignite or explode. To help prevent fire and explosion:

- Use equipment only in well ventilated area.
- Eliminate all ignition sources, such as cigarettes and portable electric lamps.
- Keep work area free of debris, including rags and spilled or open containers of solvent and gasoline.
- Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.
- Ground all equipment in the work area.
- Use only grounded hoses.
- If there is static sparking or you feel a shock, **stop operation immediately.** Do not use equipment until you identify and correct the problem.
- Keep a working fire extinguisher in the work area.

EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Do not leave the work area while equipment is energized or under pressure. Turn off all equipment and follow the **Pressure Relief Procedure** in this manual when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.

BATTERY SAFETY

The battery may leak, explode, cause burns, or cause an explosion if mishandled:

- You must use the battery type specified for use with the equipment.
- Sparking can occur when changing batteries. Only replace the battery in a non-hazardous location, away from flammable fluids or fumes.
- Handle and dispose of battery properly - do not short circuit, charge, force over discharge, disassemble, crush, penetrate, incinerate, or heat the battery to a temperature exceeding 185° F (85° C).

Set Up

- Do not install or service this equipment unless you are trained and qualified. Installing and servicing this equipment requires access to parts which may cause fire, explosion, and serious injury if work is not performed properly. Read warnings, page 2.
- Do not use the TLM with pressurized tanks.

NOTICE

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive.** Many of these products are chemically incompatible with the PC/ABS plastic.
- Use the Graco-supplied down tube 15U731 only. Do not replace down tube with any other tube.

Dipswitch Settings

The TLM has two, 4 - position dipswitches labeled S1 and S2. TLM dipswitches must be set to match those of the transceiver the TLM will be communicating with. The factory default setting for all TLM's is ('1' '1'). The first '1' refers to the Network ID and the second '1' refers to the Transceiver ID.

- **Network ID (S1):** The RF identification setting assigned to a Matrix installation. All components in the system use this same Network ID. For example, if one dealership is using Network ID (1), the dealership across the street would require Network ID (2, 3, 4, 5, 6, 7, or 8) to avoid RF interference between the two systems.
- **Transceiver ID (S2):** The RF identification setting assigned to a Matrix Transceiver(s). Matrix system components are then assigned to the Transceiver's ID as desired for RF communication. For example, if a system required two Transceivers, some components would be assigned to one Transceiver and other components would be assigned to the second Transceiver.

There are 8 Network ID's and 8 Transceiver ID's possible by changing the position of the dipswitches. The eight positions are identified as 1, 2, 3, 4, 5, 6, 7 and 8. See FIG. 2 and FIG. 3 on pages 4 and 5.

Setting the S1 and S2 Dipswitches

(Unless otherwise indicated, for the following instructions Refer to FIG. 1 and FIG. 2)

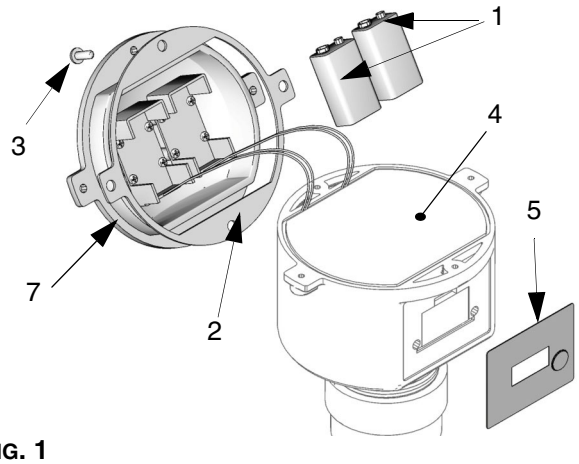


FIG. 1

1. Remove the protective plastic over cover (5) on the TLM display that was used for shipping and discard.
2. Remove the four screws (3) holding the tank monitor cover (7) in place.
3. Remove the cover (7).
4. Remove the insulating foam (4) to access the circuit board.
5. If installed, remove batteries (1).
6. Set the S1 and S2 settings to match those of the transceiver that this TLM will communicate with (FIG. 2 and FIG. 3).

NOTICE

Wait at least 30 seconds after the dipswitch settings are made before installing the batteries. If you do not wait the 30 seconds, the software will not recognize the new settings.

7. Install two, 9-volt alkaline batteries (1). Be sure that the batteries fully engage the mounting clips by pushing on the bottom of each battery with your thumb.

It will take about 30 seconds for the monitor to display information after pressing the Display button on the initial power-up. This time will decrease thereafter to a few seconds

8. Replace insulating foam (4).

Make sure the gasket (2) is not damaged and is in the correct location.

9. Replace cover (7) and secure it with the four screws (3).

Make sure the cover screws are tightened securely (18-22 in-lb) to avoid water leakage into the TLM electronics. If a torque wrench is not used, verify there are no gaps under the screw heads and no gaps under the cover flange. This will ensure proper compression of the gasket for a water-tight seal.

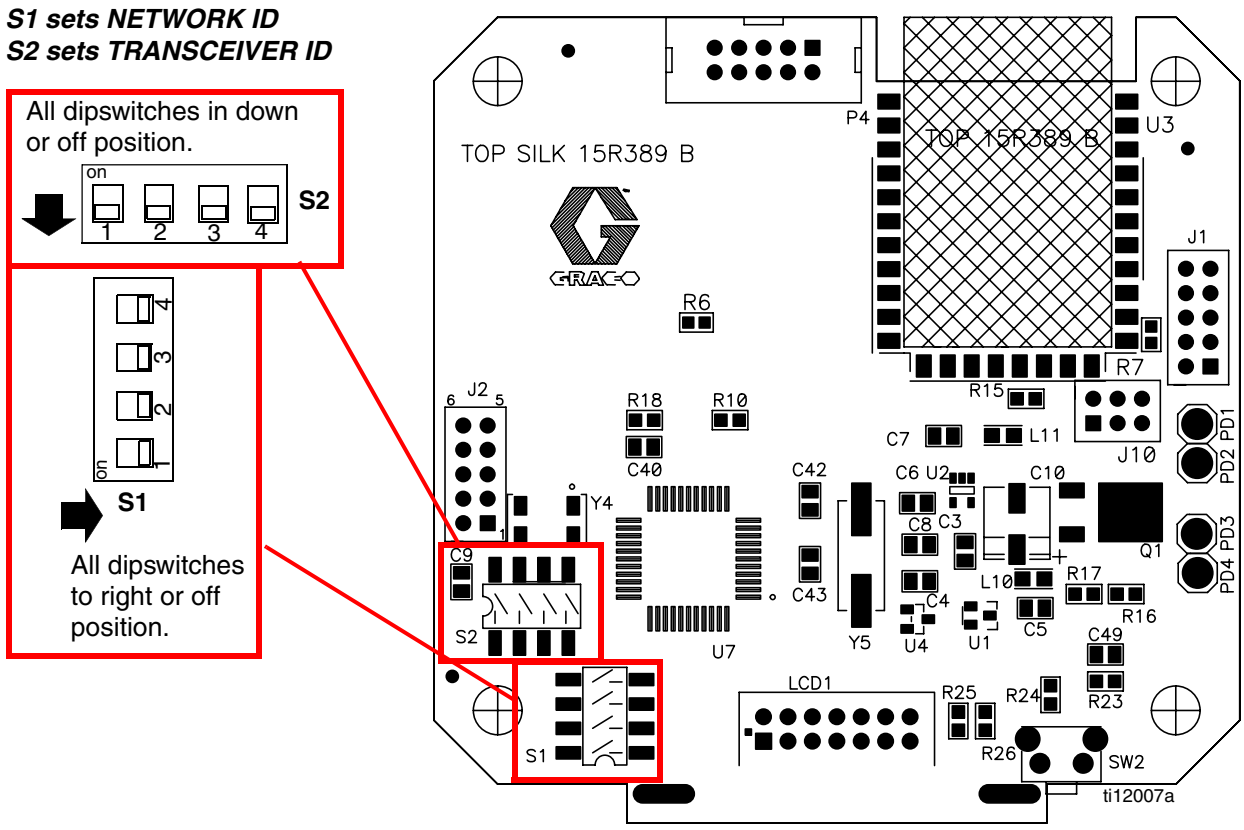


FIG. 2

Dipswitch Setting for Network ID and Transceiver ID

See FIG. 3 for dipswitch setting configurations.

The batteries must be disconnected and removed before changing dipswitch settings or the TLM will not be able to communicate with the PC software.

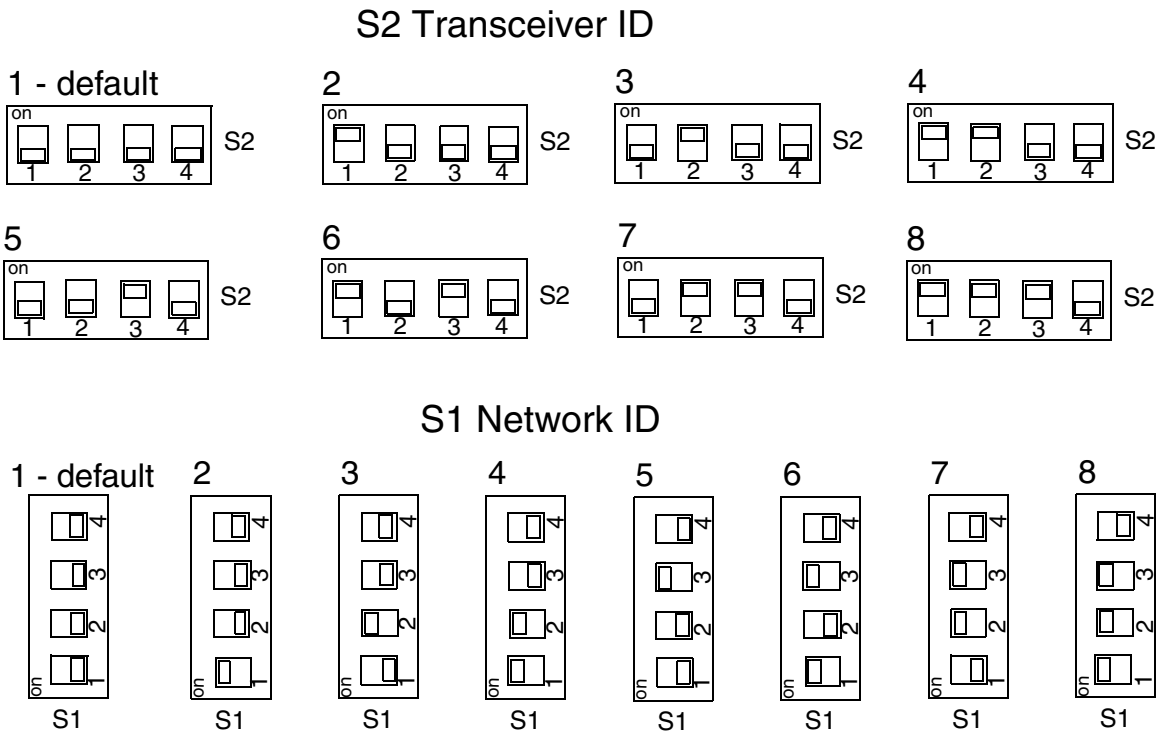


FIG. 3

Registering the TLM

Graco recommends registering TLM **prior** to installation.

The TLM operating parameters are controlled by the Matrix PC Software and setup by the System Administrator. See the Matrix 3 Software instruction manual for the PC setup instructions.

To register the TLM:

1. Set TLM to correct NETWORK ID and TRANSCEIVER ID (see Dipswitch Settings, page 5).
2. Press and hold the Display button (A, FIG. 4) until display (B) says “Register Mode”.
3. Display reads “Registration Complete” when the TLM is registered with the PC software.

See FIG. 4 for display messages you will see during Registration Mode.

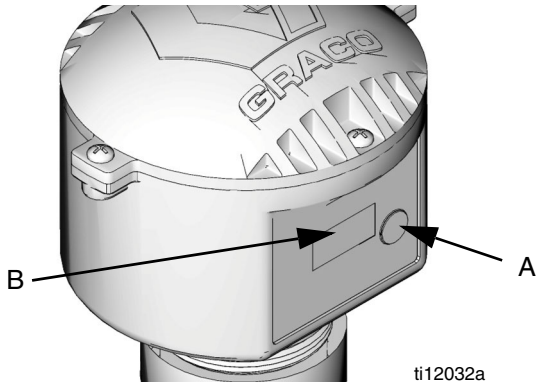


FIG. 4

TLM Display

(See FIG. 6, page 8)

TLM ID - Unique number assigned to the TLM to distinguish it from other TLM's in the system.

Battery Life - Remaining life of the unit's batteries. System Administrator on Matrix PC Software determines when Low Battery Warning message is generated.

Battery life is dependent on the number of readings taken per day.

Network ID and Transceiver ID - Shows the Network ID and Transceiver ID TLM is using (also see page 3).

Firmware - Current version of operating software controlling TLM operation.

Fluid Level - Depth of fluid remaining in the tank provided in either inches or centimeters as defined during setup.

Fluid Volume -Volume of fluid remaining in the tank, based on the tank geometry defined during setup. The TLM can be programmed to display in either gallons or liters during programming of the TLM.

Vertical tanks use this capacity figure to calculate tank volume. Obround and cylindrical tanks use the tank dimensions to calculate tank volume.

No RF Signal - Displays when the TLM is **not** receiving an RF ACK signal from the PC transceiver. If the tank level monitor is receiving an ACK signal or the signal is re-established, this screen will not appear.

If the message "No RF Signal" appears, the fluid volume and battery life data is not transmitted or updated at the PC. This message may take up to 15 seconds to display.

No PC Signal - Displays when the TLM is not receiving a response from the Matrix PC software (i.e, PC is off or software is not installed). If the TLM receives a response from the PC, this information will not appear.

If the message "NO PC SIGNAL" appears, the fluid volume and battery life data will not be updated at the PC. This message may take up to 15 seconds to display.

TLM Registration Process

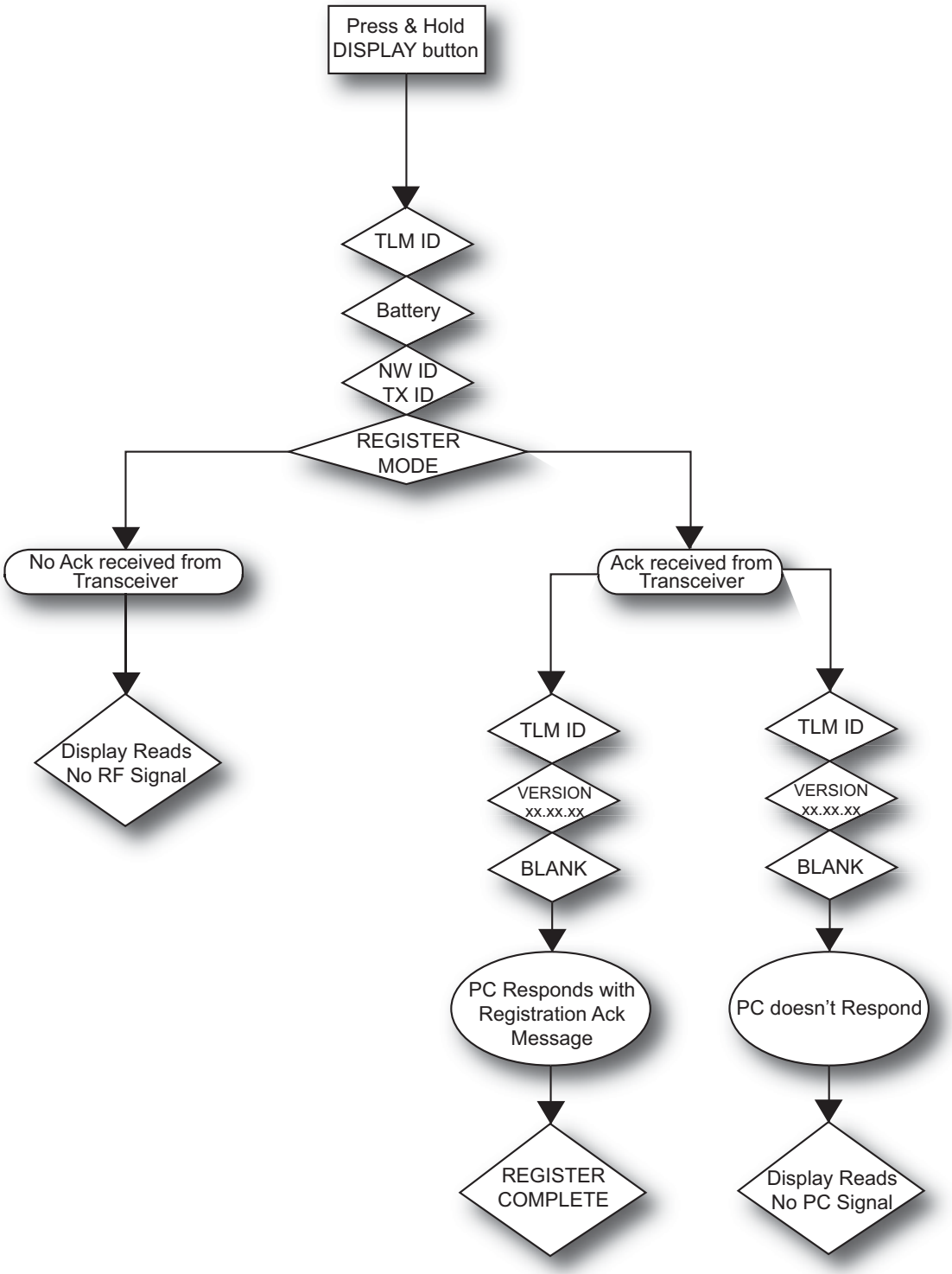


FIG. 5

Installation

NOTICE

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive!** Many of these products are chemically incompatible with the PC/ABS plastic.
- Use the Graco-supplied down tube 15U731 only. Do not replace down tube with any other tube.

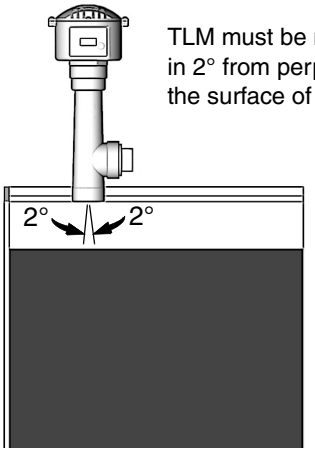
1. Remove the bung fitting and screw in the TLM hand-tight. DO NOT use a wrench to tighten as this may damage the TLM. Do not use thread lock adhesive as this may damage the TLM.

2. The TLM must be mounted within 2 degrees from perpendicular to the surface of the fluid. A level that measures degrees should be used. Place the level on the top of the pipe fitting on the tank. If outside the 2 degree specification, the fitting should be changed.

   Graco recommends that the height of the tank fitting should not exceed 1/2 in. (1.27 cm). The fitting height can be up to 2 in. (5.08 cm), provided the fitting is within 2 degrees of the surface of the fluid. Also, the taller the tank, the more critical the 2 degree specification becomes. See FIG. 6.

NOTICE

- The TLM will not operate correctly if tilted more than 2° from the surface of the tank liquid.
- The TLM will not read properly if:
  - Fluid in the tank is agitated (i.e. filling a tank with oil or anti-freeze). Be sure to take all TLM readings when the fluid in the tank is calm.
  - TLM is mounted next to the tank wall or in a corner.
  - If there is any structural bracing or obstruction between the TLM and the surface of fluid in tank.
  - If the down tube is not the Graco-supplied down tube.



TLM must be mounted within 2° from perpendicular to the surface of the fluid.

FIG. 6

NOTICE

Do not install the TLM in the tank's fill port. Repeated removal of the TLM will damage the unit and void the warranty.

Port (D) is not to be used as a fill hole for oil deliveries. See FIG. 7.

The tank's breather port might be the only available location for mounting the TLM. The horizontal 2 in. npt port (D) can be used to accommodate the breather. The breather should be mounted in an upright position using a 90° elbow fitting.

Do not use the horizontal port for routing pressure relief return tubes. This can result in inaccurate readings.

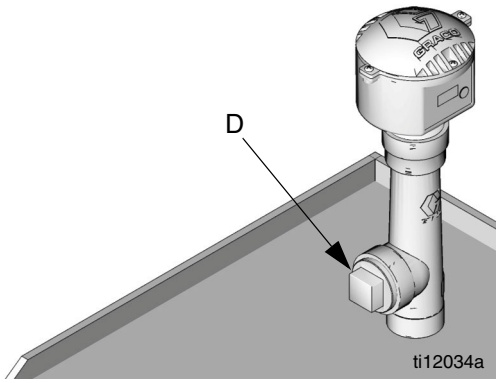


FIG. 7

Viewing Data

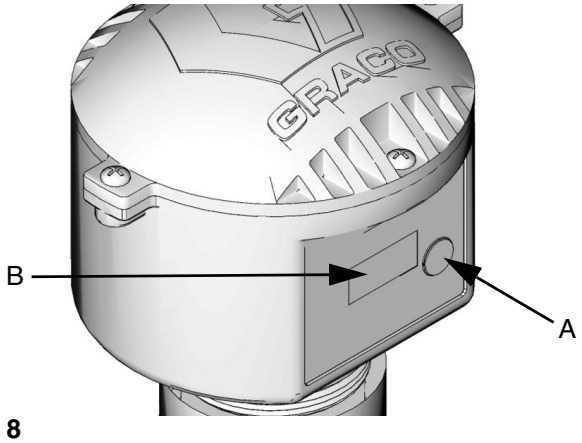


FIG. 8

Press and release the Display button (A). Data appears on display (B); each screen lasting a few seconds before going on to the next. See FIG. 8.

Tank Level data can be viewed remotely at the PC, using the Matrix software.

TLM ID 03000001	First Display
Battery 100%	Second Display
Nw ID - A Tx ID - A	Third Display
36, Fluid	Fourth Display
100 Gallons	Fifth Display (can program for liters)
No RF Signal	Screen display when **no** RF ACK signal is received after 10-12 seconds
NO PC Signal	Displays when PC doesn't respond after 10-12 seconds

FIG. 9:

After a tank is refilled from an oil distributor or a waste oil tank is emptied by a waste oil service provider, press the Display button on the TLM to ensure the TLM will maintain the most current tank volume status. If button is not pushed, the TLM will automatically read correctly at the next scheduled tank reading.

Daylight Saving Time (DST) Change

The PC software automatically changes the PC time when daylight saving time changes occur (Spring and Fall).

The first TLM reading will be 1 hour earlier or later (depending on the Spring or Fall daylight saving time change), but all subsequent TLM reading will be accurate.

Troubleshooting

Problem	Cause	Solution
Brand new monitor's display is very dim.	Unit is shipped with protective coating over display.	Remove protective coating.
Monitor displays "Invalid Reading".	The TLM reading is outside of the programmed size parameters.	Verify the programmed parameters and re-program the TLM if necessary.
Monitor will not register.	Transceiver is not powered-up.	Verify transceiver is powered-up
	Attempt to program while red lights on transceiver are lit.	Wait until red lights on transceiver go blank before attempting to register.
	Transceiver NET ID and TRANS ID not set correctly	Ensure NET ID and TRANS ID are set for appropriate communication cable.
	TLM dipswitches settings do not match transceiver settings.	Verify settings with Transceiver (see page. 5 for dipswitch setting instructions).
	Weak or dead batteries.	Replace batteries. See **Replacing Batteries**, page 13.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	USB cable or RS-422 not connected	Be sure cable are properly connected between Transceiver and PC
Monitor has intermittent RF communication	Out of RF range. RF obstruction.	Reposition Transceiver until TLM has good RF communication or add a transceiver.
	Weak or dead batteries.	Replace batteries. See **Replacing Batteries**, page 13.
Monitor is not reporting scheduled readings.	Out of RF range. RF obstruction.	Reposition Transceiver until TLM has good RF communication.
	Two TLMs are programmed to the same address.	Verify that each TLM is correctly programmed to a unique address.
	Weak or dead batteries.	Replace batteries. See **Setting the S1 and S2 Dipswitches**, page 3.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	Tank Level Monitor was not associated with profile after scheduled times were entered into software.	Reregister Tank Level Monitor and associate Tank Level Monitor with profile ID.
	Reading is scheduled when pump is operating.	Ensure readings are scheduled at times that the pump is not operating.
	Clock was changed on PC but the tank level monitor was not resychronized.	The monitor's internal clock is synchronized with the PC clock upon register or reading. Manipulating the scheduled reporting time by changing the PC clock will cause a false indication that the monitor is not reporting at the scheduled reporting times.
Monitor will not take reading when Display button is pressed.	Weak or dead batteries.	Replace batteries. See **Replacing Batteries**, page 13.
	Batteries are not correctly seated.	Ensure the batteries fully engage the mounting clips by pushing on the bottom of each battery with your thumbs.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	Monitor display is cracked.	Replace monitor display.
	PC is not running	Turn on PC. In order for TLM readings to be logged, PC must be running.

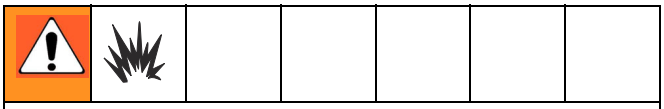
Problem	Cause	Solution
Monitor readings are inaccurate.	Tank geometry incorrectly defined.	See *Tank Level Monitor Software Guide* or *PC Software Guide* for details.
	Tank Level Monitor has not been updated with latest adjustments made within The profile ID on the PC.	Manually push DISPLAY button on TLM
	Two TLMs are programmed to the same address.	Verify that each TLM is correctly programmed to a unique address.
	Fluid surface is moving while reading is being taken.	Ensure pump is not operating and that nothing is disturbing the surface of the fluid during readings.
	Pipe adapters installed in the tank bung.	Ensure there are no adapters installed in the tank bung.
	Tank Level Monitor is not perpendicular to top of fluid.	Level tank so that it is perpendicular to top of the fluid and/or realign Tank Level Monitor.
	Inside tank obstruction.	Install in different tank bung to avoid tank obstruction.

Service

Once the Tank Level Monitor has been installed, no additional maintenance or service is necessary, with the exception of replacing batteries.

Replacing Batteries

Always replace ***both*** batteries with two new 9-volt alkaline batteries whenever you change batteries in the TLM.



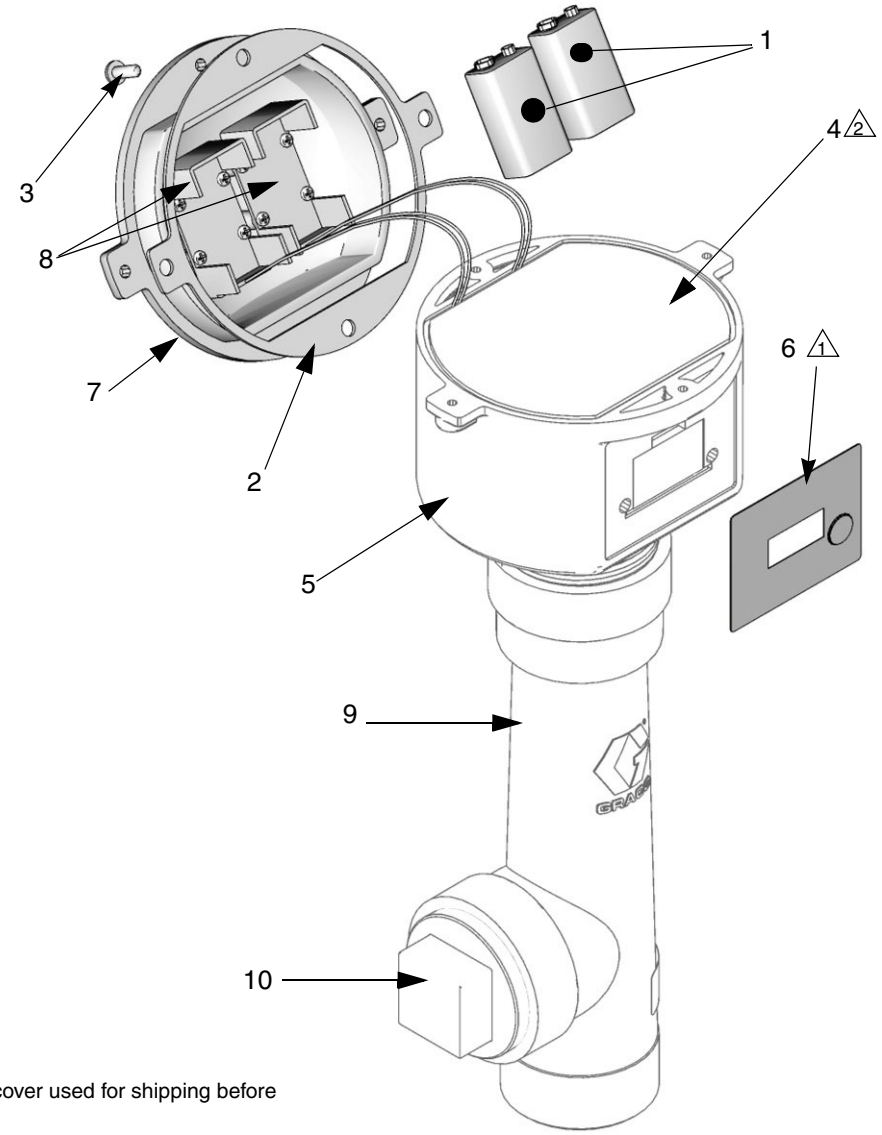
Sparking can occur when changing batteries. Only replace the battery in a non-hazardous location, away from flammable fluids or fumes.

1. Remove the four cover screws (3) and cover (7).
2. Disconnect and remove both batteries (1) from TLM and discard batteries in approved battery disposal container.
3. Replace discarded batteries with two new batteries. Be sure the batteries fully engage the mounting clips by pushing on the bottom of each battery with your thumb.
4. Replace the cover (7) and screws (3). Tighten the four cover screws.

- Make sure the cover screws are tightened securely (18-22 in-lb) to avoid water leakage into the TLM electronics. If a torque wrench is not used, verify there are no gaps under the screw heads and no gaps under the cover flange. This will ensure proper compression of the gasket for a water-tight seal.

- After changing batteries it is not necessary to reprogram the TLM. However, the Display button should be pressed to synchronize the TLM's internal clock with the PC clock. If not done, the TLM will not report at the correct scheduled times.

Parts



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1 Remove protective cover used for shipping before programming.

2 Do not remove. This is required to maintain intrinsic safety approval.

Ref. No.	Part No.	Description	Qty
1		BATTERY, 9 volt (purchased locally)	2
2	126752	GASKET, sensor, ultrasonic	1
3	117467	SCREW, self tapping, HI-LO, #10-16 x 9/16	4
4	117743	FOAM, insulator	1
5	117259	ENCLOSURE	1
6	15T814	LABEL, overlay	1
7	15A962	COVER	1
8	117469	HOLDER, battery	2
9	15U731	DOWN TUBE	1
10	119391	PLUG	

Technical Data

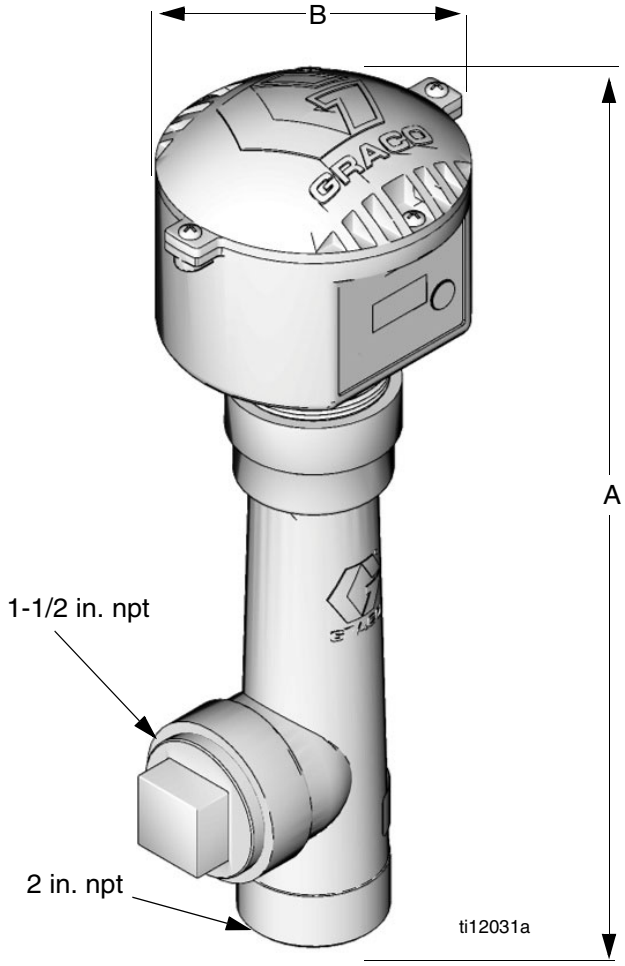
Ultrasonic Tank Depth Measurement range	0 - 30 ft. (0 - 9 m) Not for use in pressurized tanks.
Fluid Level Measurement Accuracy	+/- 0.5%
Mounting	Standard 2 in. (npt) bung.
Height above tank for TLM and tube mounting	15 in. (30.48 cm).
TLM Mounting Tube and Tank Vent	Graco recommends venting the tank separately from the TLM. If not possible, the TLM mounting and vent function can be combined if required for tanks with one hole in tank. Be sure TLM is not mounted close to tank edges or corner.
Weight (with batteries installed)	2.34lb. (1.06 g)
RF Communication	2.4 GHz
Operating Temperature Range	-22° F to 185° F (- 30° C to 85° C) Note: Display will not function below 32°F (0°C).
Storage Temperature Range	-40°F to 185°F (-40°C to 85°C)
Batteries	Two 9V alkaline
Battery Life	1.5 years
Enclosure	IP65
RF Communication	2.4 GHz
Obstructed RF Communication Range (based on building construction and RF environment)	250-300 ft (76.2 - 91.0 m)
Tank Geometry	Vertical walled tanks, cylindrical tanks, and obround tanks. •Vertical Tanks Maximum Volume 999,999 gallons or liters Maximum Height 30 ft. (360 in.) •Cylindrical Tanks Maximum Volume 999,999 gallons or liters Maximum Diameter 30 ft. (360 in.) Maximum Length 30 ft. (360 in.) •Obround Tanks Maximum Volume 999,999 gallons or liters Maximum Height 30 ft. (360 in.) Maximum Width 30 ft. (360 in.) Maximum Length 30 ft. (360 in.)
Approvals	FCC, Industry Canada (IC), C-Tick, CE

NOTE: FCC, C-Tick and IC approvals are for the RF device contained in the Matrix Tank Level Monitor (TLM).

Dimensions

A 9.1 in (231 mm)

B 4.9 in. (124 mm)



Tank Geometry

Vertical Tank:

- Maximum Volume = 999, 999 gallons or liters.
- Tank walls must be uniformly vertical from empty level to full

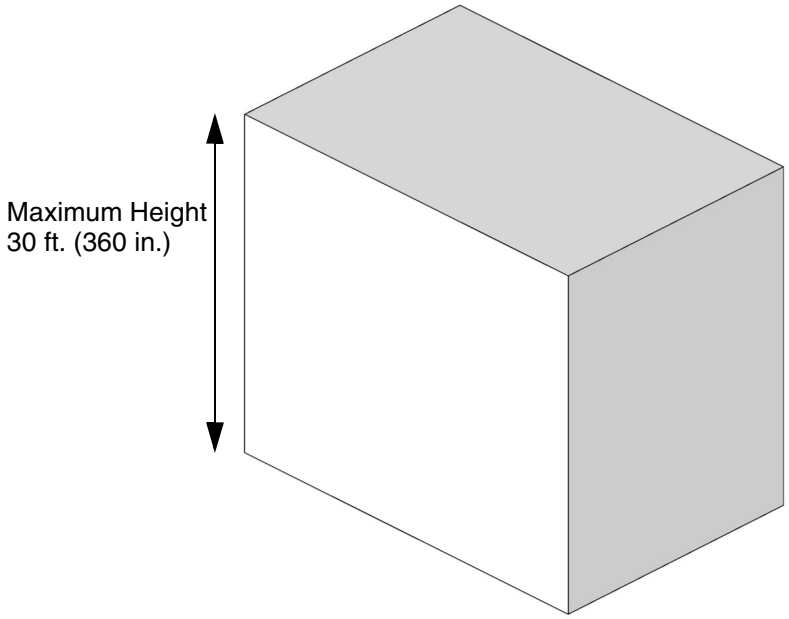


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FIG. 10

Cylindrical Tank:

- Maximum Volume = 999, 999 gallons or liters.
- Tank end walls must be flat; they cannot be any other shape, including belled.

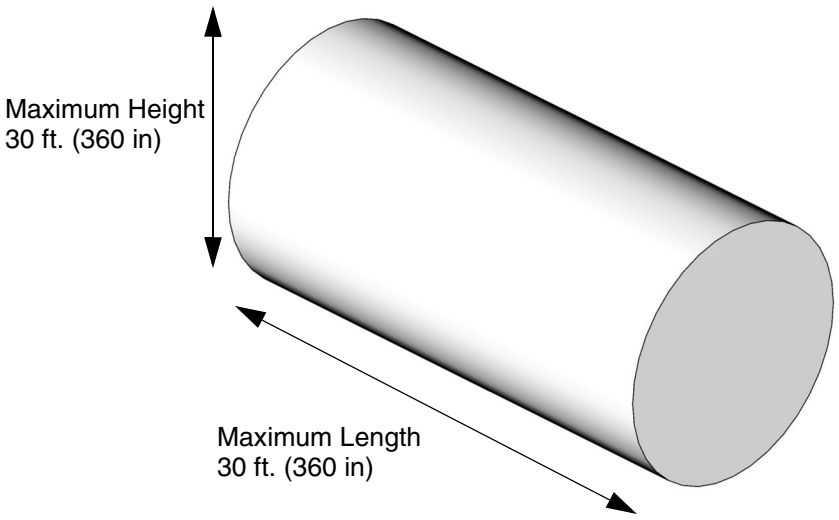

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FIG. 11

Obround Tank:

- Maximum Volume = 999, 999 gallons or liters.
- Tank end walls must be flat; they cannot be any other shape including belled.

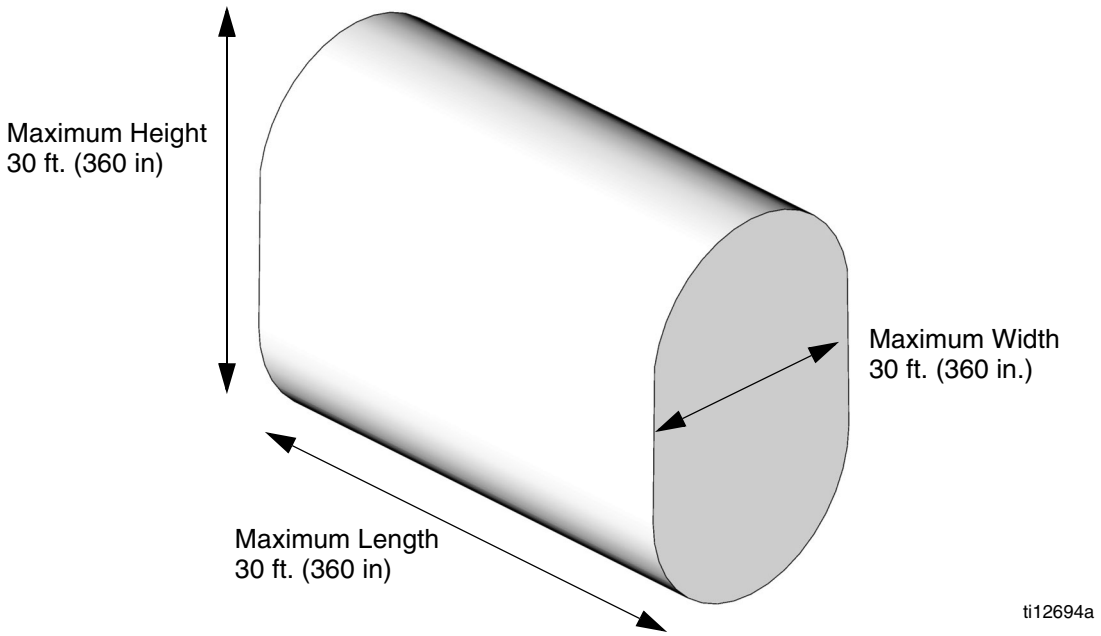

FIG. 12

Graco Extended Tank Level Monitor Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twenty four months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale Graco makes no warranty, and disclaims all implied warranties of merchantability and fitness for a particular purpose in connection with accessories, equipment, materials or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

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